College Students' Knowledge and Perceptions of Tourism Climate Change Impacts: Do Class-Level and Gender Matter?

Haoai Zhao

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Introduction

Climate change is recognized as a phenomenon that plays an increasingly important role in tourism (Berrittella, Biganoa, Rosona, & Tol, 2006; de Freitas, 2001; Smith, 1993; Gössling, Bredberg, Randow, Sandström, & Svensson, 2006; Buzinde, Manuel-Navarrete, Kerstetter, & Redclift, 2010). Many types of tourism activities are dependent on issues such as topographical changes (e.g. loss of glaciers) and changing weather patterns (Buzinde, Manuel-Navarrete, Kerstetter, & Redclift, 2010). Because of the growing effects that climate change is and will have on the tourism industry, it is important to understand the knowledge, perceptions, and subsequent behaviors that tourists and tourism providers have on climate change issues (Becken, 2007). This study sought to enhance the understanding of the relationship between tourism and climate change issues among college students. In addition, this study examined the roles that academic major, gender, and class level played in influencing college students' level of knowledge on tourism's impacts on climate change, and on their perceptions toward climate change issues. The research questions guiding this research were:

(1) What is the general level of climate change knowledge among college students?

(2) How does gender difference influence the knowledge and perceptions of climate change issues among college students?

(3) How does class level influence college students' knowledge and perceptions on climate change in tourism?

(4) Do students consider climate change impacts from their travel behaviors? If not, what factors will hinder them from considering climate change in their travel plans?

Literature Review

Smith-Sebasto (1995) suggests that the role of one's university major is a potential factor in predicting level of environmental concern and behavior. For example, environment-affiliated majors such as biology, zoology, environmental studies, and outdoor recreation, promote higher levels of environmental knowledge (Tikka, Kuitunen, & Tynys, 2000) and more pro-environmental attitudes (Anderson et al., 2007; Ewert & Baker, 2001; Harraway, Broughton-Ansin, Deaker, Jowett, & Shephard, 2012; Hodgkinson & Innes, 2001), when compared to other majors in college.

The literature on climate change knowledge and attitudes has principally focused on primary and secondary school children with only limited and dated information on college students (Wachholz, Artz, & Chene, 2014). Moreover, Leiserowitz, Maibach, Roser-Renouf, Feinberg, & Rosenthal (2014) suggests that the adoption of climate change into the curriculum of many educational institutions, particularly in higher education, is often insufficient in the United States. Perhaps related to this finding, the public attitudes toward climate change remains skeptical in the United States with findings from the Pew Research Centre (Funk & Rainie, 2015) indicating that only 50% of American adults agree that the Earth is getting warmer due to human activity.

There is considerable evidence linking higher education to pro-environmental behavior. Many empirical studies have shown that people with more years of formal education have access to more sources and types of information (Cotten & Gupta, 2004), which help them knowing where to get information on how to reduce emissions or what adaptations to take allow individuals to change behavior appropriately (Chankrajang & Muttarak, 2017). However, changing students' attitudes about human-induced climate change can often present unique challenges such as conceptual difficulties and misconceptions regarding the difference between the climate and weather (Lombardi & Sinatra, 2010; Sinatra, Kardash, Taasoobshirazi, & Lombardi, 2012; Sinatra & Mason, 2013). The topic of human's contributing role in climate change can be conceptually difficult and some students perceive it as both controversial and complex, thereby presenting unique challenges for engaging students productively with the content (Sinatra, Kardash, Taasoobshirazi, & Lombardi, 2012).

Helgeson, van der Linden, & Chabay (2012) suggest that socio-demographic factors play a key role in risk perceptions of climate change. Beyond the influence of a student's academic discipline, a number of past studies have demonstrated that gender needs to be taken into account when analyzing behavior because it can influence attitudes, beliefs, opinions, etc. (Eisler et al., 2003; Xiao & McCright, 2015). Regarding climate change, research in the past few decades consistently finds that women generally report higher levels of risk perceptions than their male counterparts (Brody, Zahran, Vedlitz, & Grover, 2008; Linden, 2015; O'Connor, Bard, & Fisher, 1999; Slovic, 1999; Sundblad, Biel, & Gärling, 2007). A number of these studies employed the theory of socialization and gender roles (Zelezny et al., 2000) that emphasize the different values and social expectations conferred to boys and girls through socialization into their society's dominant culture (Chodorow, 1978; Gilligan, 1982).

Methodology

In order to answer the research questions, a structured questionnaire was designed to collect the data. A pilot study was conducted in the interest of ensuring that the survey used clear and unambiguous language as well as avoiding obvious errors and omissions. The results of the pilot study were used to refine the questionnaire. After the pilot study (n = 68 students), the questionnaire was administered randomly to a sample of students from a mid-western university in the United States.

Sampling

The convenience sampling method was used in the data collection process. Participation was voluntarily and students could ask for an exemption from participating in the survey. The online questionnaire design and collecting software Qualtrics was utilized to collect the responses from students. Also, to increase the response rate, printed surveys were also available to the students if they preferred that method of data collection. At the conclusion of the data collection, 386 usable questionnaires were collected. From this initial sample, five graduate students' surveys were removed, resulting in a final total sample size of 381 undergraduate students.

Measurement

In this study, a five-point Likert scale was utilized in the questionnaire. The entire survey design was based on the previous studies from Hamilton and Lau (2006), McNeal et al. (2014), IPCC (2013), Kroesen (2013), Hares et al. (2010), and Dickinson et al (2013). On account for the different study purposes and backgrounds, however, only some of the measurement items were

selected and used from the previous studies in order to fit this study. The questionnaire contains two sections to evaluate the knowledge, perceptions, and barriers from the participants. Demographic questions such as sex, age, major, and ethnic group, were asked at the end of the questionnaire. A two-way ANOVA test was the primary statistical method administered in the treatment of this survey's data and was applied to compare the interaction between the sex groups and class levels. Gender and class level were treated as independent variables in this study.

The first section of the questionnaire was divided into two parts: the knowledge dimension (forty-two items) and the perception dimension (twenty-three items). According to the study, the response scale is from 0 (Don't know) to 4 (strongly agree), which correspond with the following sentiments: 'Don't know,' 'Strongly disagree,' 'Disagree,' 'Agree,' and 'Strongly agree.' In this knowledge dimension, there are seven measurement items called 'Reverse items', such as 'Climate and weather are the same thing.', 'The hole in the ozone layer contribute to global warming.', etc. Following McNeal et al. (2014), these seven 'Reverse items' were used to evaluate participants' misunderstanding of climate change knowledge. These seven items were placed with other items in the study to explore the misunderstanding and misinformation on climate versus weather, greenhouse gases, and climate change. In these measurement items, the response scale 1 'strongly disagree' represents a thorough understanding of climate change, whereas the response scale 4 'strongly agree' represents the lowest understanding of climate change knowledge.

The design of the questions in the second section of the questionnaire was based on a study by McNeal et al. (2014) to explore the barriers that students face. Totally seven Likert-type questions are scaled from 0 (Don't know) to 4 (strongly agree), and correspond to the following sentiments: 'Don't know', 'Strongly disagree,' 'Disagree,' 'Agree,' and 'Strongly agree.'

Results

Of the 381 undergraduate students analyzed in this study, 325 were female (85.3%) with the remaining 56 (14.7%) being male. The distribution of students based on university educational level (i.e. freshman to senior year), demonstrated that the majority of participants were sophomores and juniors, 30.71% and 28.87% respectively. The detailed information could be found in Table 1.

Table 1. Socio-Demographic Information

Characteristics	Dimension	Frequency	Percentage
Major	THEM	184	50.41%
	Others	181	49.59%
	Total	365	100.00%
Gender	Female	325	85.30%
	Male	56	14.70%
	Total	381	100.00%
Class Level	Freshman	55	14.44%
	Sophomore	117	30.71%
	Junior	110	28.87%
	Senior	99	25.98%

Ethnic Group	**Total**	381	100.00%
	Caucasian	195	83.33%
	African American	13	5.56%
	Hispanic/Latino	14	5.98%
	Asian	8	3.42%
	Native American/Alaska Natives	0	0.00%
	Other	4	1.71%
	Total	234	100.00%

Overall, gender seems to have little influence on college students' climate change knowledge and perceptions, except in the 'Travel impacts on climate change' section ($F(1, 373) = 5.9$, $p < .05$). Additionally, university class level influences one's knowledge of climate change and climate change perceptions, to some extent (see Table.2).

In response to Research question 1, most students are unsure if climate change is an inevitable and natural process of the earth and whether climate change is influenced by human activity. To some extent, it can be inferred that this lack of awareness and uncertainty of climate change may have influenced their performance in the subsequent sections. Interestingly, when evaluating the misunderstanding of knowledge about climate change (Reverse items), the students (mean = 1.86, SD = 0.46) responded with relatively high scores. In spite of this, most of the students regard 'the hole in the ozone layer' (mean = 3.36, S = 1.05) to be one of the factors that contributes to global warming; which is incorrect. In McNeal, et al., (2014), however, 6-20 grade American educators' showed no misconceptions of this issue, which questions why students misunderstand of the knowledge in this study concerning climate change, but their 'teachers' did not. What makes the discrepancy between the educators and the students? What pedagogical approach could the tourism educators do to correct the deficiency in climate change knowledge?

In Research Question 2, we anticipated that female students would be more sensitive to climate change issues, thus resulting in female students having a higher score than male students in the sections tracking knowledge and perceptions. In the results of climate change knowledge and perception section, female students, in most cases, had higher scores than male students. However, the two-way ANOVA analysis results show that gender has no significant influence on the level of climate change knowledge and perception, except in the knowledge section: 'travel impacts on climate change'. The low response rate of male students is a noticeable phenomenon and limitation in this study which may have influenced the results. But, the low response rate of male students also implies that referring to climate change issues, male students might have less sensitivity than female students, or male students might have less willingness to pay attention to climate change issues.

Nevertheless, in response to Research question 3, two significant differences relative to class level were found in the two-way ANOVA analysis in the climate change perception and knowledge sections. And generally, senior students, both female and male, in most cases, perform better than students of lower university educational class levels. The data in this study support the belief that 'class level' can be a mediating variable for climate change information resource for both females (mean = 2.70, SD = 1.01) and males (mean = 2.82, SD = 0.94). The powerful roles of university class, and environmental groups in the knowledge and awareness delivery are the advantages for tourism educators to consider when promoting the responsible

thinking in climate change mitigation. The two-way ANOVA analysis results could be found in the Table 2.

Table 2. Two-way ANOVA test: Comparison of Gender and Class-level influence on Climate Change Knowledge and Perceptions

Dimension		SS	df	MS	F	Sig.
Statement 1: The cause of climate change	Gender	0.6	1	0.6	1.05	0.31
	Class Level	2.88	3	0.96	1.69	0.17
	Gender * Class Level	3.21	3	1.07	1.88	0.13
	Error	212.25	373	0.57		
	Total	3235.75	381			
Statement 2: Issues affect globe temperature	Gender	1.28	1	1.28	2.38	0.12
	Class Level	1.77	3	0.59	1.09	0.35
	Gender * Class Level	0.65	3	0.22	0.4	0.75
	Error	201.37	373	0.54		
	Total	3320.19	381			
Statement 3: Issues contribute to global warming	Gender	0.01	1	0.01	0.02	0.88
	Class Level	2.75	3	0.92	1.89	0.13
	Gender * Class Level	2.7	3	0.9	1.86	0.14
	Error	180.81	373	0.48		
	Total	4507.7	381			
Statement 4: Greenhouse gasses constitution	Gender	1.31	1	1.31	0.87	0.35
	Class Level	4.84	3	1.61	1.07	0.36
	Gender * Class Level	3.8	3	1.27	0.84	0.47
	Error	561.14	372	1.51		
	Total	3801.25	380			
Statement 5: Impacts of climate change	Gender	1.38	1	1.38	2.91	0.09
	Class Level	3.66	3	1.22	2.57	0.05*

	Gender * Class Level	2.47	3	0.82	1.73	0.16
	Error	176.59	372	0.47		
	Total	3862.46	380			
Statement 6: Travel impacts on climate change	Gender	3.5	1	3.5	5.85	0.02*
	Class Level	1.33	3	0.44	0.74	0.53
	Gender * Class Level	5.82	3	1.94	3.24	0.02*
	Error	223.32	373	0.6		
	Total	3873.63	381			
Statement 7: Climate change misunderstanding	Gender	0.21	1	0.21	0.28	0.6
	Class Level	3.12	3	1.04	1.37	0.25
	Gender * Class Level	2.89	3	0.96	1.27	0.28
	Error	281.52	372	0.76		
	Total	3640	380			
Statement 8: Perceptions on climate change	Gender	0.41	1	0.41	1.57	0.21
	Class Level	2.65	3	0.88	3.43	0.02*
	Gender * Class Level	1.26	3	0.42	1.63	0.18
	Error	96.05	372	0.26		
	Total	2066.14	380			
Reverse Items: Climate change misunderstanding	Gender	0.13	1	0.13	0.6	0.44
	Class Level	1.71	3	0.57	2.67	0.05*
	Gender * Class Level	1.24	3	0.41	1.93	0.12
	Error	79.38	372	0.21		
	Total	1398.11	380			

In terms of Research Question 4, the data show that both female and male students do not strongly consider climate change issues in their travel (mean = 1.95, SD = 0.82), with price (mean = 3.08, SD = 0.97) being more important than climate change in their travel destination decision-making process. Moreover, these results for both female and male students were quite

similar. In this section, an attitude-behavior gap was found, as well. The analyzed results in this section imply that even though students think they can do something pro-environmentally in reducing their consumption in travel, in actuality, they might not be able to do so.

Conclusion and Discussion

While the results of this study suggest that college students have some concerns regarding climate change there exists uncertainty over knowledge of climate change. In general, most students are unsure if climate change is an inevitable and natural process of the earth and the relationship between climate change and human activity. Price and lack of awareness of tourists' roles in climate change mitigation might be the factors that influences students considering climate change in their travel decision-making. The attitude-behavior discrepancy, found in this study, has also been observed in many previous pro-environmental behavior studies.

The climate change knowledge and perceptions in this study cannot be attributed to gender differences. Although gender does influence students' knowledge of travel impacts on climate change, females understanding more than males, no other significant gender influence was found in general climate change knowledge and perceptions. To some extent, university educational level has an impact on students' climate change perceptions, and climate change knowledge. In these two sections, senior students received higher scores than students in lower class levels, and 'class of university' is regarded, for both females and males, as a critical resource for climate change information.

The results of this study suggest that current climate change education among college students may not be sufficient to encourage a students' stronger sense of responsibility toward climate change mitigation. Thus, the results of this study beg the question as to what should be included in tourism class curriculum design and would these inclusions be distinguishable from other majors' class?

A number of other implications emerge from the findings of this study. First, if the sample used in this study, is representative of other college students, given the linkage between climate change and tourism, the results suggest that climate change related content may not be presented enough, from both quantity and quality aspects, in many tourism programs. It is important to consider how tourism students are exposed to climate change issues. In line with this, tourism educators could embed real-life examples of climate change knowledge and mitigation options for students in their class, offering them more possibilities to participate into the climate change mitigation activities, particularly in view of the fact that many students may not know how to engage into those pro-environmental behaviors (Li & Monroe, 2018). Examples of this knowledge building and mitigation opportunities would include Internet programs from organizations such as NASA, invited government, NGO, and tourism operators that are directly experiencing the effects of climate change, and field excursions observing the effects of drought, etc. Secondly, it is important to study different groups of people in order to understand people's attitudes in general, which will, in turn, help tourism students better understand how policy makers gain support for climate change policies and programs. Third, for the tourism educators it is important to understand students' knowledge level and perceptions toward the climate change issues in order to apply or design proper pedagogical approach to teach the students, especially in the area of dispelling myths and inaccurate information in addition to understanding how tourism activities such as extended air travel can impact climate change.

For the future studies, sample populations should include participants with multiplex of socio-demographic backgrounds to get more representative results and reduce possible bias in the data. Also, promoting climate change related knowledge and mitigation awareness to the tourism class will support the implementation of climate change policy in the tourism industry, since the students in the tourism class will be the potential consumers and future leaders/employees in the tourism industry. Thus, it is important for future studies to focus on establishing suitable strategies to foster public engagement in climate change mitigation and adaptation.

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